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a′ through layer d′, and a set of four four-pair waveguide plates 17 identified as layer e′ through h′. The waveguide plates 16 and 17 of Figure 8 contain the requisite twenty-eight waveguide pairs [15] 18 for the preferred embodiment. The plate identification letters also appear in sequence a′-h′ in the optical waveguide stack of Figure 1. Each wave guide plate 16 and 17 in Figure 8 is circumscribed with cardguide or station letters a through h to indicate particular cardguide stations with respect to each plate and cardguide stations with respect to each transmit/receive waveguide pair. It will be further observed in Figure 8 that waveguide plates a′-d′ and e′-h′ are rotated with respect to each other and assume four different angular positions. In the preferred embodiment of Figure 8 the plate to plate angular separation is 45°. It is to be seen then, that the circuit board assembly 11 in Figure 2 for card guide a has no electro-optical interface 13 at the position of layer c′ because, as shown for layer c′ in Figure 8, there is no optical waveguide terminus for cardguide at the position of layer c′. For the same reason, the circuit board assembly e for layer c′ omits an electro-optical interface 13 at layer c′, and so forth for layers a′, b′, and d′.

Those skilled in the art recognize that there are several methods of construction to achieve the desired configuration of waveguide plate. For example, the optically opaque body can be machined to form slots for the transparent waveguide pairs [20] 18. The waveguide pairs also can be machined to

fit. The optically opaque body 19 can be injection molded leaving voids where the waveguide pairs are to reside with a secondary molding operation with optically transparent material used to form the waveguide pairs [20] 18.

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A table showing a matrix of interconnections for the electro-optical interfaces of eight circuit board assemblies a-h and waveguide terminuses for waveguide plates a'-h' is shown in Figure 3. For example, the circuit board assembly installed at optical backplane station d has electro-optical interfaces in optical registry with the waveguide receive ports 9a and transmit ports 10a of waveguide plates or layers e', a', f', g', c', h', and d'. The diagonal of the table shows that it is not necessary to connect a circuit board assembly to itself through an optical backplane. The table also shows the orthogonal nature of the interconnection scheme where the matrix portions above and below the diagonal are mirror images. This orthogonal symmetry represents the paired nature of the interconnect for optical transmission and reception.

Figure 9 of the drawing depicts a transparent end-on view of the vertically stacked full mesh backplane of the preferred embodiment circumscribed with letters representing the same cardguide stations of Figures 1 and 8. The twenty-eight pairs of optical waveguides are superimposed to illustrate in Figure 9 that each circuit board assembly a–h is connected to every other circuit board assembly for optical transmission and